Calculation of Baseline Emissions for Biomass Project

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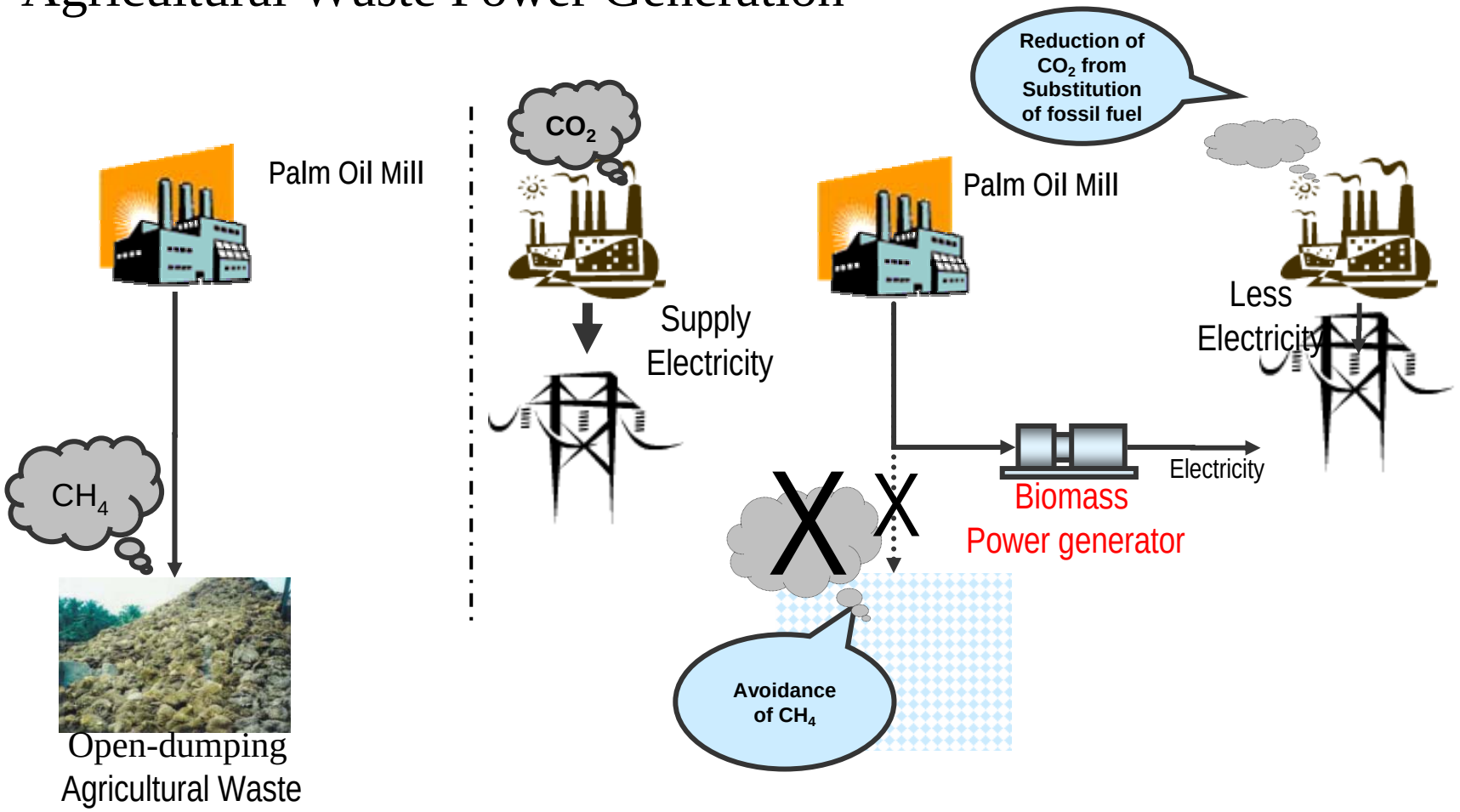
How does “Biomass project” reduce GHG?

- Avoid CH4 emission by preventing biomass from anaerobic decay (AMS III.E.)
  - Controlled combustion
  - Gasification to produce syngas/producer gas
  - Mechanical/thermal treatment to produce refuse-derived fuel (RDF) or stabilized biomass.

- Reduce fossil fuel consumption by generating renewable energy
  - Reduce coal by generating steam from wood chips
  - Reduce diesel oil for in-house power generation by utilizing rice-husk for power generation
  - Reduce power generation of thermal power plant by supplying power to the grid

- Agricultural Waste Power Generation



Some conditions are required.

- Generating renewable energy
  - the biomass must fit the EB definition of "biomass" which is categorized as "*renewable biomass*"

- Preventing biomass from anaerobic decay
  - the biomass must emit CH4 in anaerobic conditions

What is “renewable biomass”?

Biomass is “***renewable***”, if the biomass is:

- Biomass originating from land areas that are **forests**,
- **Woody biomass** and originates from **croplands and/or grasslands**,
- **Non-woody** biomass and originates from croplands and/or grasslands,
- **Biomass residue**, or
- Non-fossil fraction of an **industrial or municipal waste**.

Biomass is “***non-renewable***”, if the use of the biomass leads to the decrease in carbon stock.

i.e. Use of dead wood from the forest that would otherwise have remained unused. Unsustainable forest harvesting and biomass utilization.

What is “biomass” in CDM?

- **Biomass** means non-fossilized and biodegradable organic material originating from plants, animals and micro-organisms. This shall also include products, by-products, residues and waste from agriculture, forestry and related industries as well as the non-fossilized and biodegradable organic fractions of industrial and municipal wastes. Biomass also includes gases and liquids recovered from the decomposition of non-fossilized and biodegradable organic material. (EB20)
- **Biomass residues** means biomass by-products, residues and waste streams from agriculture, forestry and related industries. (EB20)

Which emission to be considered?

Table 1. Emission source per type of biomass

Biomass type	Activity / source	Shift of pre-project activities	Emissions from biomass generation / cultivation	Competing use of biomass
Biomass from forests	Existing forests	-	-	x
	New forests	x	x	-
Biomass from croplands or grasslands (woody or non-woody)	In the absence of the project the land would be used as cropland / wetland	x	x	-
	In the absence of the project the land would be abandoned	-	x	-
Biomass residues or wastes	Biomass residues or wastes are collected and used	-	-	x

Competing uses for the biomass:

The biomass would be used even in baseline scenario?

No → No leakage (to be deducted from the emission reduction.)

Yes → Some leakages (if the project activity cause additional use of fossil fuel.)

Even "Yes", no leakage would be considered if there is a surplus of the "unused" biomass in the region of the project activity

- If it is demonstrated that the quantity of available biomass in the region (e.g. 50 km radius), is at least 25% larger than the quantity of biomass that is utilized including the project activity, then this source of leakage can be neglected. (EB28)

Baseline Emissions

$BE_y = BE_{CH4,SWDS,y}$ + BE_power,y

BE_y	Baseline emissions at year "y" during crediting period (tCO_2e)
$BE_{CH4,SWDS,y}$	Yearly Methane Generation Potential of the wastes diverted to be disposed in the landfill from the beginning of the project (x=1) up to the year "y", calculated according to the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" (tCO_2e).

BE_power,y CO2 emissions that would otherwise occur at the fossil fuel power plants of the grid, which the project activity would supply electricity, to generate the electricity to be replaced by the project activity.

MW * hours/year * CO2 emission factor of the grid

Project Emissions

$$PE_y = PE_{y,comb} + PE_{y,transp} + PE_{y,power}$$

PE_y	Project activity direct emissions in the year "y" (tCO_2e)
$PE_{y,comb}$	Emissions through combustion and gasification of non-biomass carbon of waste and RDF/SB in the year "y"(tCO_2e)
$PE_{y,transp}$	Emissions through incremental transportation in the year "y"(tCO_2e)
$PE_{y,power}$	Emissions through electricity or diesel consumption in the year "y"(tCO_2e)

$$PE_{y,comb} = Q_{y,non-biomass} * 44/12 + Q_{y,fuel} * EF_{y,fuel}$$

$Q_{y,non-biomass}$	Non-biomass carbon of the waste and RDF/SB combusted/gasified in the year "y" (tonnes of carbon)
$Q_{y,fuel}$	Quantity of auxiliary fossil fuel used in the year "y" (tonnes)
$EF_{y,fuel}$	CO_2 emission factor for the combustion of the auxiliary fossil fuel (tonnes CO_2 per tonne fuel, according to latest IPCC Guidelines)

$$PE_{y,transp} = \left(Q_y / CT_y\right) * DAF_w * EF_{CO2} + \left(Q_{y,ash} / CT_{y,ash}\right) * DAF_{ash} * EF_{CO2} + \left(Q_{y,RDF/SB} / CT_{y,RDF/SB}\right) * DAF_{RDF/SB} * EF_{CO2}$$

Q_y	Quantity of waste combusted, gasified or mechanically/thermally treated in the year "y" (tonnes)
CT_y	Average truck capacity for waste transportation (tonnes/truck)
DAF_w	Average incremental distance for waste transportation (km/truck)
EF_{CO2}	CO_2 emission factor from fuel use due to transportation (tCO_2/km, IPCC default values or local values)
$Q_{y,ash}$	Quantity of combustion and gasification residues and residues from mechanical/thermal treatment produced in the year "y" (tonnes)
$CT_{y,ash}$	Average truck capacity for residues transportation (tonnes/truck)
DAF_{ash}	Average distance for residues transportation (km/truck)
$Q_{y,RDF/SB}$	Quantity of RDF/SB produced in the year "y" (tonnes)
$CT_{y,RDF/SB}$	Average truck capacity for RDF/SB transportation (tonnes/truck)
$DAF_{RDF/SB}$	Aggregate average distance for RDF/SB transportation to the storage in the production site as well as to the end user sites (km/truck)

$PE_{y,power}$	Calculated by using carbon emission factor of grid electricity or fuel used.

Exercise

Let's calculate...

Project type:
Grid-connected biomass power generation

The emission reduction activities:

-Avoid CH_4 emission from biomass decay (in anaerobic condition)

-Displace electricity from the power grid

The methodologies to be applied:

-Type III.E. *"Avoidance of methane production from decay of biomass through controlled combustion"*

- Type I.D. *"Grid connected renewable electricity generation"*

- Assumptions for calculation (1/2)

Project emissions	**(i) CO_2 emissions through combustion of non-biomass carbon** ➢ Non-biomass carbon is not included in the biomass. ➢ 100 t of Diesel oil will be used as auxiliary fuel annually. **(ii) CO_2 emissions through incremental transportation of biomass to the project site** ➢ Biomass to be used by the project activity: 100,000 ton/year ➢ Approximate loading capacity for a truck: 10 ton/truck ➢ Average distance to the power plant: 50 km (one way) ➢ No combustion residue will cause incremental transportation. **(iii) CO_2 emissions through electricity or fossil fuel consumption** ➢ No electricity/diesel is consumed by the project activity other than auxiliary fuel.

- Assumptions for calculation (2/2)

Baseline emissions	**(i) CH_4 emissions avoided from preventing waste (biomass) disposal at the SWDS** ➢ It is assumed that the biomass residues are either dumped or left to decay under mainly aerobic conditions without utilizing it for energy purposes. ➢ Biomass used by the project activity: 100,000 tonne/year ➢ The SWDS is categorized as "Unmanaged-shallow solid waste disposal site" (MCF = 0.4) ➢ The type of the biomass is "Wood and wood products" **(ii) CH_4 emissions that would be captured and destroyed to comply with national requirements etc.** ➢ Any of the requirements will not be established during the crediting period. **(iii) Emission reductions due to displacement of electricity (AMS-I.D)** ➢ Grid emission factor: 0.8 t-CO_2/MWh ➢ Power generation (supply) capacity: 1 MW ➢ Load factor: 100% ➢ Annual operation hours: 8,400 hours

Values for MCF

Data / parameter:	**MCF**
Data unit:	-
Description:	Methane correction factor
Source of data:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value to be applied:	Use the following values for MCF: • 1.0 for **anaerobic managed solid waste disposal sites**. These must have controlled placement of waste (i.e., waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) leveling of the waste. • 0.5 for **semi-aerobic managed solid waste disposal sites**. These must have controlled placement of waste and will include all of the following structures for introducing air to waste layer: (i) permeable cover material; (ii) leachate drainage system; (iii) regulating pondage; and (iv) gas ventilation system. • 0.8 for **unmanaged solid waste disposal sites – deep and/or with high water table**. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 meters and/or high water table at near ground level. Latter situation corresponds to filling inland water, such as pond, river or wetland, by waste. • 0.4 for **unmanaged-shallow solid waste disposal sites.** This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of less than 5 metres.